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ABSTRACT

This document provides teachers and students with the opportunity to learn about the "Bone Wars" of the frontier West, the smartest dinosaur, current hot topics in paleontology research, and how to bring the study of fossils to life with hands-on activities for both the classroom and outdoors. Includes a list of teaching resources. Contains 19 references. (CCM)

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Set in Stone

By Harley Armstrong, Carl Barna, Richard Brook, Mike O'Neill, and Mary Tisdale

ED 432 457

PEABODY MUSEUM OF NATURAL HISTORY, YALE UNIVERSITY

Deinonychus, a Cretaceous killer from Montana displays its deadly claws.

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From the tiniest bacteria to some of the largest creatures—fossils are clues that help us solve the fascinating riddles of how life on Earth evolved. Fossils are fascinating because of their natural beauty and the mystery and wonder they evoke about ancient worlds we can only imagine.

Students as well as professional paleontologists can make important discoveries about fossils. Although much has been discovered about ancient life-forms, there is still a great deal more to learn about our planet and its earliest inhabitants. In this article and on the back of the companion foldout, teachers and students can learn about the "Bone Wars" of the frontier West, the "smartest" dinosaur, current "hot topics" in paleontological research, and how to bring your study of fossils to life with the hands-on activities suggested for the classroom and the outdoors.

INSTITUTE FOR CAMBRIAN STUDIES

Cambrian trilobite from the Chief Range, Nevada.

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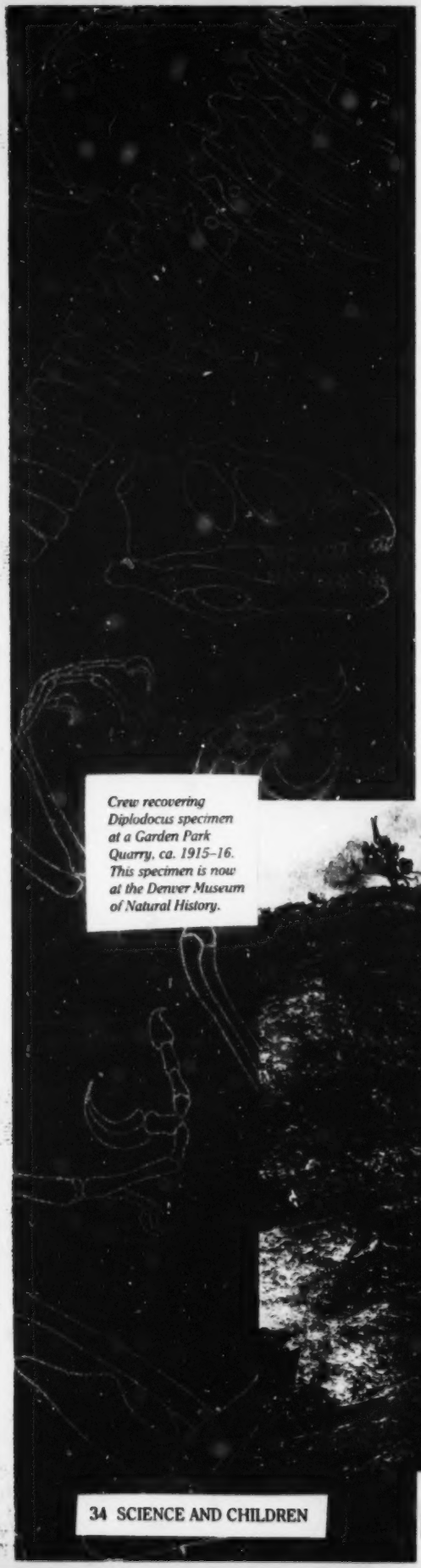
Golden Spikes and Golden Opportunities

Paleontology emerged in the American West even before the Civil War. President Thomas Jefferson instructed Meriweather Lewis and William Clark to include fossils in the collections they made during their great exploration of 1804–1806. Later explorations and surveys, made as part of efforts to find a railroad route and locate mineral deposits, also noted the presence of fossils. When the Transcontinental Railroad was completed in 1869, it did more than just help people get from here to there faster. The coming of the railroad produced one of the most productive and exciting periods in the history of American science, a period that captured the public's imagination and produced some of the most colorful figures any branch of science could claim. It ignited a paleontological explosion, a great "bone rush" to the West, that filled America's new museums with awe-inspiring creatures whose hold on our imaginations has never waned.

In 1870, Professor O.C. Marsh of Yale, America's first professional vertebrate paleontologist to work in the West, led the first of many expeditions into the western territories. On Marsh's first trip out, William F. "Buffalo Bill" Cody served as a guide, and the two soon became friends. Like Cody, Marsh was an avid outdoorsman, a skilled hunter, and a keen shot. Because the 1870s were a period of intense conflict between American Indians and Euro-American settlers and miners, Marsh's expedition traveled with a military escort, one of the benefits of his connections with Civil War generals William T. Sherman, Philip H. Sheridan, and others. In addition to the army escorts, he was able to use army wagons, supplies, and other equipment. Many of the soldiers and their Indian scouts brought him fossils they found. The Pawnee Indians even dubbed Marsh the "Bone Medicine-Man."

Into this scene strode Marsh's most bitter rival and antagonist, Professor Edward Drinker Cope of the Academy of Natural Sciences in Philadelphia. One of the leading scientists of his day, Cope eventually was the author of some 1,400 books, papers, and monographs. Soon, the competition began—the race to find more, bigger, and the most spectacular dinosaurs. A contributing cause for the feud was a misconstruction by Cope of a marine reptile named *Elasmosaurus* in 1868. Upon viewing the specimen, Marsh embarrassed Cope by pointing out that he had placed the head of the animal on the end of its tail. After that, there was no going back.

The Bone Wars were waged in places like Como Bluff in Wyoming and Garden Park in Colorado. The bloodless war took a variety of forms. One side would bribe the other's field workers for information on discoveries and locations, or send collectors to work localities claimed by the other. Telegraph messages were intercepted. Today, they might have read each other's e-mail! In the end, the war broke both men financially, but science and the American public gained much from their rivalry. Twenty-eight new genera of dinosaurs were discovered and new collecting techniques were developed. Workers developed a technique of wrapping fossils in plaster and burlap, a technique still used by vertebrate paleontologists to protect brittle fossils. Cope's collections became a strong component of the American Museum of Natural History



Crew recovering Diplodocus specimen at a Garden Park Quarry, ca. 1915–16. This specimen is now at the Denver Museum of Natural History.

DENVER MUSEUM OF NATURAL HISTORY, PHOTO ARCHIVES

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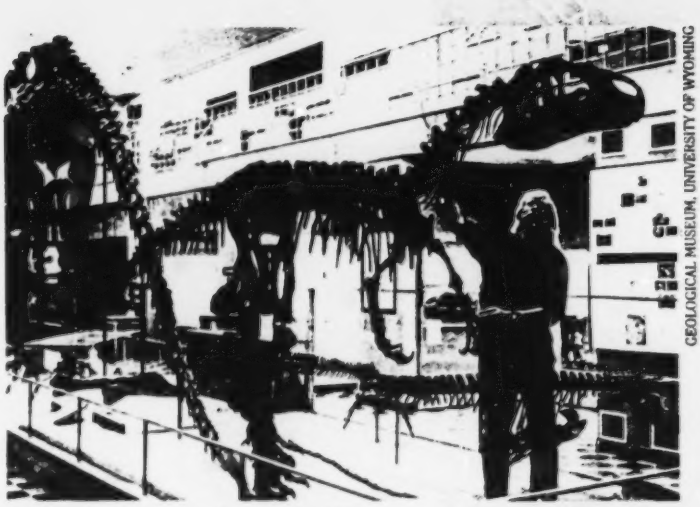
in New York, while Marsh's collections went on to the Yale Peabody Museum in New Haven, Connecticut, and to the Smithsonian Institution.

Since the dinosaur hunting days of Cope and Marsh, the practice of paleontology has undergone a revolution. A century ago, paleontologists were concerned with finding the biggest, or the most complete, specimens they could in order to fill the nation's new museum halls with awe-inspiring public displays of mounted skeletons. Prevailing interpretations of dinosaurs, for instance, portrayed them as huge, tail-dragging, cold-blooded, dim-witted, plodding creatures that lived in a hot, humid world viewed as little more than one big swamp. Today, a visit to most natural history museums reveals a vastly different picture. We see active creatures populating a variety of habitats, from lush to arid. Discovery and analysis of dinosaur trackways and nesting sites have led many paleontologists to believe that some of these creatures cared for their young. Other discoveries, such as the dinosaur *Deinonychus*, reveal creatures that were swift and intelligent predators that may have hunted their prey cooperatively in packs, similar to the wolves of today. Other studies suggest that many of the dinosaurs may have been able to regulate their body temperatures.



GEOLOGICAL MUSEUM, UNIVERSITY OF WYOMING

Fossils from public lands are displayed for public enjoyment the world over. This cast of the most complete Allosaurus ever found is on display at the Geological Museum of the University of Wyoming.

For today's scientists, the goal is not simply to identify the life-forms preserved in the sedimentary rocks of the Earth's crust, but also to provide answers to questions about how these organisms lived and died, what their environments were like, how they grew and evolved, and how they related to other forms of life. Experts in many technical fields are often consulted about fossil finds; many of these scientists are also specialists.

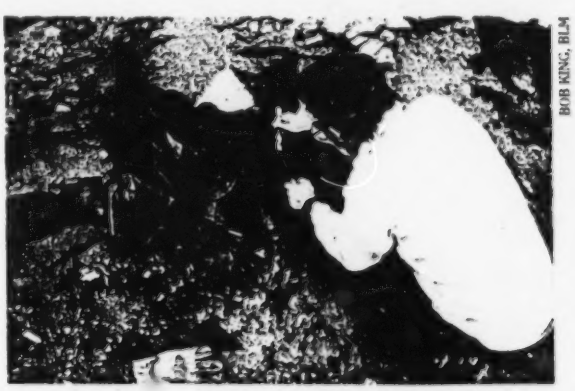
When working with fossil plants, animals, and related organisms, paleontologists try to form a picture of how a life-form once fit into its environment. Such scientific specialties as paleobiology, paleobotany, paleoecology, paleoenvironmental reconstruction, evolutionary biology, and sedimentology are used to study fossils in the context of their environmental surroundings. For example, scientists can compare the pollen and spores found with the bones of dinosaurs to those produced by modern plants and reconstruct what the environment was like when these animals walked the Earth.

AL LIGRANI, RESEARCH CENTER AND SPECIAL LIBRARY, MUSEUM OF WESTERN COLORADO

Fossils must be prepared before they can be properly studied. This view shows matrix being removed.

JERRY VAN WYNGARTEN, RESEARCH CENTER AND SPECIAL LIBRARY, MUSEUM OF WESTERN COLORADO

A hundred years ago, paleontologists faced the challenge of hauling tons of fossil specimens by wagon over nearly impassable terrain. Today, paleontologists borrow freely from the technological advances in other fields, such as this Army helicopter.



BOB KING, BLM

Since the mid-1980s, paleontologists have been making exciting discoveries of dinosaurs along Alaska's Colville River. These Cretaceous finds have extended the known range of dinosaur habitats and have produced new theories about dinosaur migration and adaptation to harsh climates.

Paleontologists also look at the organism as a whole. This can involve studies of anatomy, comparative morphology (bone shapes), biometrics, and pathology (sickness and injury). It may include the

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DENNIS FINNIN, AMNH

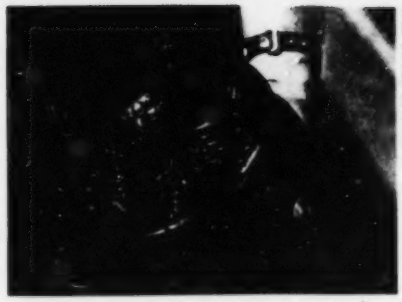
Notharctus, one of the most complete lemur-like primate specimens known from North America. This Eocene forest-dwelling mammal was found in Wyoming.

PALEONTOLOGY: The Study of Ancient Life Frozen in Time

Derived from the Greek word meaning "ancient individuals," paleontology is the study of fossils, the remains or traces of any ancient organism preserved in the Earth's crust, or, possibly, on another planet. Organisms become fossils in many ways—a fish sinks to the bottom of a lake and is buried in soft mud, animals grazing on the plains are buried by the sudden eruption of volcanic ash, shell debris accumulates slowly on the ocean floor.

Fossilization is a rather chancy business. Fossil formation is affected by the rate of burial of the organic remains. Also, organisms have a better chance of being preserved if they have hard parts, such as bones, shells, teeth, or wood. Such hard parts are less likely to be disturbed or eaten by other organisms. The petrification of remains or the mold-and-cast process are two ways in which these hard parts of organisms eventually produce fossils.

Remains of organisms become petrified when groundwater containing dissolved minerals seeps into the tiny natural openings of buried bones or other porous parts of dead organisms. As the water slowly passes through the organism, the minerals crystallize and settle out, filling the pores. Petrified remains are hard and rocklike because some or all of the original materials have been replaced by new, harder minerals. In the mold-and-cast process, the sediments around an object are compacted and cemented until they become rock. A mold results from simple solution of the original object in groundwater. Later, other sediments may fill the mold, harden into rock, and produce a cast of the original object.



RICHARD BROOK, BLM

Scientists base much of their understanding of fossil animals on studies of living animals they are related to or resemble. Some organisms, such as the horseshoe crab and ginkgo tree, are called "living fossils," organisms that have remained virtually unchanged since before the time of the dinosaurs. Why they survived and dinosaurs didn't is one of the many mysteries pondered by paleontologists who study extinctions.

study of related fossils such as fossil dung (coprolites) and stomach or gizzard stones (gastroliths). Looking closer and even microscopically at fossil organisms includes the study of microbiology, and may include development of cells and tissues (histology), biochemistry, biophysics, and DNA studies. A lot of these microbiology studies have been popularized recently through the release of books and movies like *Jurassic Park* and *The Lost World*.

Fossils are important in reconstructing the geologic history of places, from individual rock layers to entire continents. Fossils can be used to correlate rocks from one area to another, to correlate strata with absolute chronological dates, and to provide relative age dating. On a larger scale, fossils are useful for determining the geography of ancient land and marine deposits, and tracing the transformation of the Earth's land and water forms, including continental drift.

In the field of biology, paleontologists often try to explain the behavior of animals and are interested in how organisms reproduced. Did vertebrate animals give live birth, or were they hatched from eggs? What did they eat or consume? What were the "demographics" or population dynamics or migration routes of various fossil organisms when they were alive? Sometimes looking at scars and scar tissues on bones, and endocranial casts (brain and central nervous system) of animals will indicate modes of behavior and result in hypotheses about possible interactions with the environment and other living creatures. The study of ichnofossils, or tracks and trace fossils, is important in determining various interactive behaviors.

The study of paleontology has and continues to be one of the greatest detective mysteries, the classic investigation of who, what, where, when, why, and how. While the American frontier of Cope and Marsh has long since disappeared, the field of paleontology is still on the edge of discovery. New fossil discoveries continue to expand our understanding of the relationships of organisms, their adaptations and possible lineages over time, and other aspects of the history of our planet.

BLM

Evidence of mass mortalities in the fossil record, such as these Eocence Knightia from Wyoming, provide spectacular glimpses into the changes and deaths of ancient ecosystems. These fish are related to present-day sardines.

The great Cretaceous extinction that ended the dinosaurs was only one of several "mass extinctions," the rapid and extensive turnover of organisms that occurred several times during the history of life on Earth, and it wasn't even the most catastrophic. For example, the great Permian extinction eliminated an estimated 95 percent of extant species compared to about 76 percent at the end of the Cretaceous.

With regard to the extinction of the dinosaurs, theories range from the impacts of disease to increased volcanic activity at the end of the Cretaceous to an asteroid that crashed into the Earth. The effects of the last two are suspected of producing major climatic change. Increased levels of atmospheric dust from these events is believed to have reduced sunlight enough to produce lowered temperatures and impaired plant photosynthesis, the basis of the Earth's food chain. Yet another theory is that while the dinosaurs are gone, the birds we see everywhere today are their descendants, produced by a long series of evolutionary changes that led to new species. This theory is based on many similarities between the bone structure of creatures such as Deinonychus and ancient birds such as Archaeopteryx.

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FOSSILS: A National Treasure

Many fossils can be found on public lands managed by the Bureau of Land Management (BLM) and other federal agencies. These fossils are a national treasure jointly owned by all Americans. Many of the vertebrate fossils in America's public museums came from these lands. One recent example of a rare fossil found on public lands is the skull of *Parasaurolophus*, found in the De-Na-Zin Wilderness Area in New Mexico. This is one of only about a half-dozen known specimens of this dinosaur. *Parasaurolophus* was a type of duckbilled dinosaur that lived about 75 million years ago when New Mexico was a lush, tropical area. The dinosaur was about 9 m long and weighed two to three metric tons—the size of a small elephant. This skull has recently been CAT-scanned and it's so well preserved that paleontologists can now learn much more about the sounds these dinosaurs may have made with their crests.

Students and teachers may collect some kinds of fossils on BLM public lands. Sedimentary rocks produced in oceans, lakes, rivers, caves, and floodplains of rivers are often good places to look for fossils. The shells and other hard parts of animals that live in these places accumulate over a period of several years and then are buried by sediments. Fossils that may be collected include reasonable amounts of invertebrate fossils, such as trilobites, brachiopods, and gastropods, as well as fossil plants; and limited quantities of petrified wood.

Because of their relative rarity, scientific importance, and fragility, vertebrate fossils may not be collected except under permit by qualified individuals. However, many museums and colleges do offer opportunities for volunteers to study and work alongside trained professional paleontologists. These rules of collection apply specifically to BLM public lands.

When planning a field trip to an area, teachers should always check with the public or private landowner to determine whether or not fossil collecting is permitted, and if so, what types of collection are permissible.

Fossils of all kinds are the only direct evidence we have of past life. As such, they are irreplaceable natural resources for science. It is important for students to understand that fossils should be used wisely, and that the students themselves can participate in their conservation and study. Amateur collectors should always follow standards of professional ethics, including discussing their finds with experts in a position to recognize exceptional or valuable specimens.

Hadrosaur neck vertebrae from New Mexico.

KEITH RIGBY, JR., BLM

Rib cage of a hadrosaur (duckbill) dinosaur from Cretaceous of New Mexico.

KEITH RIGBY, JR., BLM

KEITH RIGBY, JR., BLM

Paleontological field work can be both arduous and exciting. Painstaking care must be exercised to prevent damage to fragile bones as they are removed from the ground.

JOHN BEBOUT BLM

Scientists are able to determine the "age" of different rock layers as an oil well is drilled. If oil is found in a particular rock layer, geologists will "target" rocks of the same age in each new well they drill in the area. Because rocks of the same age may look completely different from one another, only micropaleontologists who examine the pollen fossils in the rocks can say for sure that they are the same. And if no oil is found, micropaleontologists can tell the geologist when to stop drilling. This can save a great deal of money as drilling can cost hundreds of dollars per foot.

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FOR THE CLASSROOM

Dino Dentures

The teeth of *Apatosaurus* were incapable of efficiently crushing or grinding food to prepare it for digestion. How, then, was digestion accomplished? Clues to the digestion system of large herbivorous dinosaurs come from birds, which do not have teeth to chew their food. Parakeets swallow gravel and keep it in their gizzard, a muscular pocket in the digestive tract. As the muscles cause the walls of the gizzard to move, the gravel crushes the food.

BLM

BLM's Cleveland-Lloyd Dinosaur Quarry, a National Natural Landmark since 1964, has produced material such as this Allosaurus skull for dinosaur exhibits in over 40 museums worldwide. The remains of over 60 of these Jurassic flesh-eaters have produced one of the most complete growth records of any known dinosaur.

Reasonably strong evidence exists that large dinosaurs like brontosaurs and diplodocids also had gizzard stones, probably several rocks capable of efficiently crushing and grinding ingested food. The large dinosaurs pulled vegetation as needed with their thin, peglike teeth, and rather than waste valuable energy on chewing, swallowed the food. The gizzard "chewed" as the dinosaur walked. This was a far more efficient system because these dinosaurs could ingest new food as they "chewed" the old food.

Materials: You will need a handful of pebbles, 120 mL water, pieces of lettuce or grass, a 2 L plastic soda bottle, a colander, and a bowl or bucket.

Procedure: Place the pebbles, water, and pieces of lettuce or grass in the bottle and put the cap on tightly. Pass the bottle around the room, allowing each student to shake it 15–20 times. After all students have had the opportunity to shake the bottle, have students form a circle. Place a colander over a bowl or bucket and pour out the bottle contents. The vegetables will be crushed. Discuss how they have been pulverized without being chewed. Students can try this experiment with other vegetables or plant materials at home—carrots, celery, tree leaves—and compile a list of how many shakes it takes to pulverize different materials.

Making a Good Impression

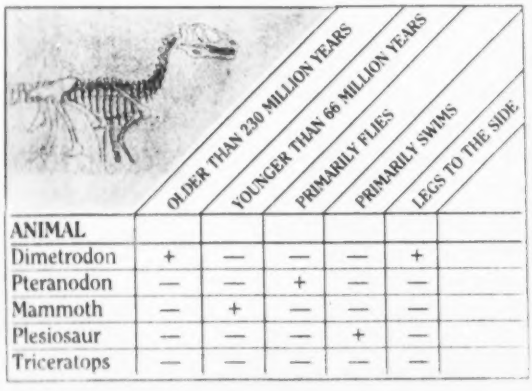
Have students determine which types of sediments would best preserve fossils. Students can press shells or bones into various thick mixtures, such as sand and water; clay and water; and gravel, clay, and water. The ability of a mixture to "preserve" should be judged on the clarity of the imprint made. (Clay will hold the best imprint. Gravel will be the least able to hold an imprint.)

Paleo Classifieds

In this activity, students fill in a semantic feature analysis chart, a method of graphically analyzing relationships among many different species. This allows students to develop vocabulary, categorization, and classification skills and to identify relationships.

Prepare a grid with prehistoric animal types listed on the left side of the grid and features or characteristics written across the top (such as those shown on the sample chart). Possible characteristics of dinosaurs or other animals include carnivorous/herbivorous, bipedal/ quadrupedal, horned/not horned, grazer/browser, size, time period during which it lived, and continent(s) where it was found.

If a characteristic is present in a certain type of animal, students should mark a plus (+) in the space; if it is not present, students mark a minus (-). Grids can be prepared individually or in small groups, or a large wall-size grid can be made for use by the entire class.



ANIMAL	OLDER THAN 230 MILLION YEARS	YOUNGER THAN 66 MILLION YEARS	PRIMARILY FLIES	PRIMARILY SWIMS	LEGS TO THE SIDE	
Dimetrodon	+	—	—	—	+	
Pteranodon	—	—	+	—	—	
Mammoth	—	+	—	—	—	
Plesiosaur	—	—	—	+	—	
Triceratops	—	—	—	—	—	

What's in a Name?

Dinosaur names are often chosen from Latin or Greek on the basis of three categories:

- the place of discovery,
- the name of the discoverer or some expert in the field,
- or a description of the animal or some feature of its anatomy.

By far, the greatest number of dinosaur names are descriptive, revealing the shape, analogy to a modern animal, behavior, size, or some other anatomical feature of the animal. Although they often seem to be merely long strings of random letters, the names of the animals are combinations of word roots that describe something about the animal.

For example, combining the three roots *tri-*, from Latin meaning "three," *cerat-*, from Greek meaning "horn," and *-ops*, from Greek meaning "face" gives the name for *Triceratops*, a dinosaur with a three-horned face.

Dinosaur names can also describe where the animal was first discovered. For example, *Albertosaurus* was discovered in the province of Alberta, Canada. Other dinosaur names honor the person who was instrumental in the discovery. For example, *Lambeosaurus* was named for Lawrence Lambe, a paleontologist with the Geological Survey of Canada.

Activity: Have students decipher the following dinosaur names by looking through the dictionary for words that may contain the various roots. All these names are based on rules established by the International Code of Zoological Nomenclature overseen by the International Commission on Zoological Nomenclature. Fossil plant names are governed by the International Code of Botanical Nomenclature. All of these dinosaur types have been found on America's western public lands:

- *Pentaceratops* ("five-horned face")
- *Camptosaurus* ("bent lizard")
- *Stegosaurus* ("plated lizard")
- *Allosaurus* ("strange lizard")
- *Ceratosaurus* ("horned lizard")
- *Marshosaurus* ("Marsh's lizard")

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UNIVERSITY OF CALIFORNIA, BERKELEY, MUSEUM OF PALEONTOLOGY

Boy Scouts examine the partial skull of a baby triceratops.

- *Stokesosaurus* ("Stokes' lizard")
- *Barosaurus* ("heavy lizard")
- *Camarasaurus* ("chambered lizard")
- *Haplocanthosaurus* ("single-spined lizard")
- *Deinonychus* ("terrible claw")
- *Seismosaurus* ("Earth-shaking lizard")
- *Diplodocus* ("double beam")
- *Apatosaurus* ("deceptive lizard")
- *Dryosaurus* ("oak lizard")
- *Brachiosaurus* ("arm lizard")
- *Amphicoelias* ("with hollow-ended vertebrae")
- *Elaphrosaurus* ("light lizard")
- *Coelurus* ("hollow tail")
- *Torvosaurus* ("savage lizard")

Body Building—Mesozoic Style

The body structure of animals is a system of balanced beams and masses. The center of mass is the balance point of a body. Explain to students that the bodies of animals must be balanced or they will fall due to the pull of gravity. Bipedal dinosaurs were able to keep both feet on the ground and used their tails to provide balance when they leaned over. The tail likely served as a counterweight, or force to balance the weight of the front end and massive head. As a bipedal dinosaur moved its head up or down, the tail moved in the opposite direction.

Activity: Students can easily demonstrate the concept of a counterweight. Working in pairs, one student places a pencil on the floor and observes as the second student stands on one leg, and without bending the knee (just bending over from the waist), reaches for the pencil on the floor. The observing student should notice that the student bending over extends the second leg backward as a counterweight. Dinosaurs did the same thing using their tails.

To explore other aspects of body balance, students can build any dinosaur body they want using commonly available materials such as straws, pipe cleaners, cardboard tubes, rubber bands, paper clips, elastic bands, marshmallows, or Styrofoam balls. Have students share with the class how balance is achieved in that body system. Encourage them to experiment with both bipedal dinosaurs such as *Tyrannosaurus rex* as well as quadrupedal dinosaurs such as *Diplodocus*.

Fossilization: The Road to Immortality

Fossilization is a rare event. The chances of a given individual being preserved in the fossil record are very small. Some organisms, however, have better chances than others because of the composition of their skeletons or where they lived. This also applies to the various parts of organisms. For example, plants, invertebrates, and vertebrates are made up of different parts that can separate after death. The different parts can be transported by currents to different locations and be preserved separately. A fossil toe bone might be found at one place and a fossil rib at another location. We could assume that they are from different animals when, in fact, they came from the same one.

Much is lost in the fossilization process. Much of what we consider important about human biology is in the soft tissues, such as skin, hair, and internal organs. These characteristics would usually be unknown in the fossil state, because most of the time only bones and teeth are preserved. Bones and teeth are not always preserved together.

Activity: This exercise is designed to encourage children to think about the quality of information that comes from the fossil record. To begin, have students list facts about a living animal, such as a horse. The list of facts on the horse might include—but not be limited to—large size, fast runner, eats grass, has grinding teeth, has long hair for a mane and tail, whinnies, is intelligent, is sociable with other horses, makes a good pet.

Ask students, "What would we know if this animal were extinct?" Show students an image of a horse skeleton and point

UNIVERSITY OF CALIFORNIA, BERKELEY, MUSEUM OF PALEONTOLOGY

A budding paleontologist studies fossils.

out an important generalization of fossilization: most of the time, only the hard parts (bones and teeth) are preserved as fossils. Go through the list of characteristics about the horse and ask the class what we would know about horses if they were extinct and all we had were fossilized bones and teeth. We would know it was a large animal and could probably make some good guesses about its weight. We would know it had grinding teeth and, therefore, we could probably guess that it ate some sort of tough vegetation like grass. The hooves would not be preserved, but the shape of the foot bones would be a good indicator that it had hooves. The skeleton would also be useful to tell us it was a fast runner. Few details of the hair or skin would be known. Everything about social behavior and vocalization would also have to be guesses.

Pass out a picture of a *Stegosaurus* skeleton. Have the class draw muscles and skin on the skeleton. Explain to students that skin color and texture are largely the choice of the artists, since fossil bones provide no clues, although some skin impressions have been found.

Certain of the activities presented above were adapted with permission from the author from Investigating Science with Dinosaurs *by Craig A. Munsart (1993).*

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Teaching Resources

Interpreted Paleontological Sites on Public Lands

Interpreted paleontological sites on public lands managed by the Bureau of Land Management can be found in several states. No fossil collecting is allowed in these special areas so that all visitors may enjoy seeing the fossils. You can find a complete listing of interpreted paleontological sites on public lands on the BLM's environmental education Web site at http://www.blm.gov/education/education.html.

Paleontology Loan Kits

The Bureau of Land Management offers paleontology kits to teachers in Colorado and Wyoming on a loan basis. For further information, teachers should contact the nearest BLM office (listed under U.S. Government in the telephone directory).

Paleontology on the World Wide Web

Today, vast audiences are finding answers to questions about ancient life-forms from a new source—the World Wide Web. True, you can't replace the thrill of actually seeing the fossil, but the Web does allow us to glimpse the diversity of past life and to continue to learn from the fossil record.

Many of these sites are increasingly interactive and stress the process of science as well as the content. There are numerous paleontology sites on the World Wide Web. To get started, take a look at the following. (*Please Note:* These sites are not maintained by the Bureau of Land Management. As with any Web site, teachers should prescreen the materials contained at these sites to assess their appropriateness for classroom use.)

- The University of California Museum of Paleontology, http://www.ucmp.berkeley.edu
- The Paleontological Research Institution, http://www.englib.cornell.edu/pri/
- The Royal Tyrrell Museum, http://www.tyrrellmuseum.com/
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Limb bones from unidentified dinosaur from New Mexico.

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